Excessive precipitation, etc.—Continued.

States and stations.	Monthly, 6 inches, or more.	Specially heavy.					
		2 inches, or more, per day.			At rate of 1 inch, or more, per hour.		
		Am't.	Duration.	Date.	Am't.	Duration.	Date.
			h. m.			h. m.	
Missouri.							
Conception	.....	2.00	*	3	.....	.....	.....
New Jersey.							
Tenafly	6.01	2.80	.....	25	.....	.....	.....
New York.							
White Plains	10.43	3.90	24 00	20	.....	.....	.....
Garrison	.....	2.02	24 00	21	.....	.....	.....
Utica	.....	2.25	.....	4, 5	.....	.....	.....
North Carolina.							
Salem	6.42	.....	.....	.....	.....	.....	.....
Southport	6.25	.....	.....	.....	.....	.....	.....
Wilmington	6.22	3.41	25 10	20, 21	.....	.....	.....
Pennsylvania.							
Easton	7.25	.....	.....	.....	.....	.....	.....
Wellsborough	.....	3.00	15 40	18, 19	.....	.....	.....
South Carolina.							
Abbeville	7.75	.....	.....	.....	.....	.....	.....
Evergreen	7.50	2.14	.....	25	.....	.....	.....
Newbury	6.43	2.00	.....	24	.....	.....	.....
Balfast	6.25	.....	.....	.....	.....	.....	.....
Cedar Springs	6.00	3.52	.....	25	.....	.....	.....
Black's	.....	2.00	.....	25	.....	.....	.....
Texas.							
Galveston	7.54	3.75	12 58	22	3.31	1 00	22
Austin	.....	4.27	32 30	14, 15	.....	.....	.....
Cedar Hills	.....	3.50	24 15	22, 23	.....	.....	.....
Corpus Christi	.....	.....	.....	.....	1.30	1 00	4
Vermont.							
Manchester	.....	2.10	19 00	20	.....	.....	.....
Washington Territory.							
Neah Bay	7.86	.....	.....	.....	.....	.....	.....

*Less than 24 hours.

In the following table are given rainfalls of 2.50 inches or more per day, and of 1 inch or more per hour, as shown by records of self-registering rain-gauges at stations of the Philadelphia Water Department:

Station.	Length of record.	2.50 inches or more per day.			1.00 inch or more per hour.		
		Date.	Duration.	Amount.	Date.	Duration.	Amount.
			h. m.	*Inches*		h. m.	*Inches*
Frederick	1885-'7	Aug. 3, 1885	16 30	a5.04	Aug. 3, 1885	0 24	1.00
Doylestown	1884-'7	June 26, 1884	8 50	4.00	June 26, 1884	0 14	0.50
		Aug. 3, 1885	15 0	c5.89	Aug. 5, 1884	1 14	b2.03
		May 8, 1886	23 13	3.42	Aug. 3, 1885	0 20	1.50
		June 22-23, 1887	9 7	2.51	July 30, 1887	0 12	0.76
Philadelphia (Water Dep't.)	1885	Aug. 3, 1885	13 24	3.86	July 6, 1884	1 0	1.50
		May 8, 1886	27 30	3.36	July 7, 1885	0 29	0.90
		June 22-23, 1887	10 54	2.97	Aug. 3, 1885	1 25	2.80
		Sept. 11-12, 1887	10 5	2.66	Aug. 25, 1885	0 56	1.15
					May 8, 1886	0 11	0.16
					July 23, 1887	0 44	d1.86
					July 26, 1887	0 33	e1.16
Forks of Neshaminy.	1886-'7	May 8, 1886	18 18	2.46	July 29, 1887	0 42	1.16
		June 22-23, 1887	12 39	3.12			

a, of this amount, 3.27 inches fell in 4 hours and 8 minutes; rate per hour, 0.78. *b*, 1.30 of this amount in 20 minutes; rate per hour, 3.90. *c*, 4.40 of this amount in 1 hour and 43 minutes; rate per hour, 2.52. *d*, 0.92 of this amount in 13 minutes; rate per hour, 4.26. *e*, 0.62 of this amount in 7 minutes; rate per hour, 5.34.

For the above data the Chief Signal Officer is indebted to Chief Engineer John L. Ogden, Board of Public Works, Philadelphia, Pa.

The most remarkable of these rainfalls were those of August 3, 1885, on which date more than 5.00 inches fell at Frederick and Doylestown, more than 3.00 inches falling in about four hours at the former station, and nearly 4.50 inches in one hour and forty-three minutes at the latter station, while the amount given for thirteen hours in Philadelphia is nearly 4.00 inches. The storm of July 26, 1887, appears to have given the heaviest rate of fall per hour (5.34 inches); but this storm was of short duration, the actual amount of rainfall being 0.62 inch for seven minutes; it is, therefore, possible that this fall may have been equalled or exceeded in some of the other storms recorded, and it is probable that during the remarkably heavy fall at Doylestown on August 3, 1885, a rate of fall was attained which would have given a much larger amount than 2.52 inches per hour, the actual fall for that storm.

Rainfalls of four inches or more, and the heaviest rainfalls of each year, during a single storm, at Saint Louis, Mo., from 1838 *to* 1887, *as shown by records of the late Dr. G. Engelmann* (*from* 1838-'77) *and of the signal office* (1878-'87).

Year.	Month.	Date.	Duration.	Am't.	Year.	Month.	Date.	Duration.	Am't.
			h. m.	*Inch.*				h. m.	*Inch.*
1838	January	6-7	14 00	2.07	1861	March	31	10 00	2.34
1839	June	7-8	30 00	2.81	1862	December	13-14	30 00	4.47
1840	October	18	21 00	3.73	1863	August	9-10	25 00	3.86
1841	August	22	5 00	4.78	1864	May	10	10 00	2.34
1842	June	30	16 00	1.96	1865	March	29-30	40 00	4.90
1843	June	9	2 00	2.30	1866	August	31	3 00	3.23
1844	May	15-16	33 00	4.37	1867	May	27	18 00	4.42
1845	May	22	11 06	3.70	1868	August	* 30	11 00	3.99
1846	June	3-4	15 00	4.00	1869	November	16	18 00	3.15
1847	October	20-22	49 00	6.59	1870	August	2	4 00	2.50
1848	May	6	3 00	5.22	1871	January	13-14	42 00	3.00
	June	2	5 00	6.17	1872	June	27	4 00	*3.49
	June	21-22	29 00	7.55	1873	June	9-10	27 00	3.90
	August	15	1 00	5.05	1874	May	2-4	28 00	2.58
1849	July	5-6	30 00	3.88	1875	June	17	3 00	3.10
1850	November	26-27	26 00	4.38	1876	June	29-30	16 00	2.43
1851	August	2-3	21 00	3.95	1879	June	1	13 00	1.64
1852	March	11-13	53 00	5.54	1878	August	9-10	11 00	3.23
1853	May	2-3	35 00	2.88	1879	April	14	5 00	2.00
1854	April	26-27	22 00	4.34	1880	May	8-9	8 00	1.32
1855	August	15	8 00	4.19	1881	November	17-18	26 40	2.99
1856	April	30	5 00	3.80	1882	February	19-20	24 00	4.44
1857	February	6	9 00	2.91	1883	August	15	1 35	1.85
1858	July	11	10 00	4.18	1884	October	4	1 25	1.34
	December	4	15 00	5.00	1885	June	19-20	14 05	3.12
1859	June	18-20	30 00	7.83	1886	September	4	4 20	2.62
1860	June	2-3	12 00	3.73	1887	November	26	7 35	2.32

*Gauge filled and ran over.

NOTE.—The duration of the rain, as given above, covers some time when the rain is very light.

The record at Saint Louis shows that during the last forty-seven years storms giving rainfalls of four inches or more occurred nineteen times, and that these nineteen storms occurred in thirteen years, leaving thirty-four years of the period free from such storms. The duration of the storms giving four or more inches of rainfall ranges from one and one-quarter to fifty-three hours, the average being about twenty-one hours. The total duration of all storms (for which the precipitation was four or more inches) was four hundred and sixteen hours, and the aggregate rainfall 91.42 inches, the average per hour being 0.23 inch. By months, these storms occurred as follows: 1 in February; 2 in March; 1 in April; 3 in May; 4 in June; 1 in July; 3 in August; 1 in October; 1 in November; 2 in December; none occurred in January or September, and about forty per cent. of the entire number occurred in May and June. The year 1848, with respect to these storms, was the most remarkable one of the whole series, there having been four in that year; the same year also shows the maximum rate of fall, viz., 5.05 inches in one hour and fifteen minutes on August 15th.

WINDS.

The most frequent directions of the wind during February, 1888, are shown on chart ii, by arrows flying with the wind. In most districts the prevailing winds of the month were variable, as will be seen from the chart; they were, however, generally from southwest, west, or northwest in the Lake region, New England, and the middle Atlantic states.

HIGH WINDS.

No maximum velocities of fifty or more miles per hour, other than those given in the table of miscellaneous meteorological data, have been reported.

LOCAL STORMS.

Chester, Nassau Co., Fla.: at 6.30 a. m. on the 7th a severe

hail storm, lasting five minutes, occurred here; no serious damage resulted.

The "Charlotte (N. C.) Chronicle" of the 11th states that a hail storm occurred during the evening of the 10th between Charlotte and Columbia, S. C., along the line of the Charlotte, Columbia, and Augusta Railroad.

The "New York Times" of the 25th contains a report from Evansville, Vanderburg, Co., Ind., which states that a tornado passed through Vanderburg and Gibson counties on the afternoon of the 24th, causing much damage to buildings, etc.

A special dispatch to the "Missouri Republican" (Saint Louis) from Piedmont, Wayne Co., Mo., on the 19th, states that a tornado occurred near that place at 2.30 p. m. on the date mentioned. The path of the tornado is reported to have been about two hundred yards wide; it destroyed several buildings on the farms through which it passed. The course of the storm was from southwest to northeast for a distance of eight miles.

Between 4.30 and 5 o'clock on the afternoon of the 19th a tornado destroyed a large part of the town of Mount Vernon, Ill. (population about 8,000). Eighteen persons are reported to have been killed, and about three times that number were more or less seriously injured. About one hundred buildings were destroyed, among which was the county court-house, a large and substantial structure of brick and stone. Concerning this storm the "Chicago Tribune" of the 22d states: "The starting point of the storm which devastated Mount Vernon seems to have been near the old town of Kaskaskia, Randolph Co., not far from the Chester Penitentiary. Heavy timber was mown down in this vicinity, and the house of John Bond was destroyed, and himself and wife injured. The force of the wind seems to have 'scattered' as it passed in a northeasterly direction, and, while it did some damage at Steeleville, Randolph Co., and left a trail across Perry County, the damage was confined to wrecked buildings, no loss of life having been reported. Passing between Duquoin and Pinckneyville the storm turned due northeast, concentrated its energies, and swept upon Mount Vernon with the result the dispatches have outlined. No great amount of damage was done beyond Mount Vernon."

Rockford, Ohio Co., Ky.: reports from Mason's Landing, on Green River, state that during the evening of the 19th a storm destroyed a number of buildings in that vicinity, entailing losses amounting to several thousand dollars.

Wilkesbarre, Pa.: a number of buildings were unroofed and trees blown down during a violent storm which occurred here on the morning of the 25th.

INLAND NAVIGATION.

STAGE OF WATER IN RIVERS AND HARBORS.

In the following table are shown the danger-points at the various stations, the highest and lowest depths for February 1888, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark, February, 1888 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
Red River:						
Shreveport, La.....	29.9	19, 20	20.6	4	18.8	1.8
Arkansas River:						
Fort Smith, Ark ...	22.0	5	9.2	20–23	3.4	5.8
Little Rock, Ark...	23.0	8	10.5	25	3.2	7.3
Missouri River:						
Omaha, Nebr*.....	18.0	.....	.....	.....	.....	.....
Leavenw'rth, Kans.	20.0	20, 24	9.5†	28	7.4†	1.1
Mississippi River:						
Saint Paul, Minn*..	14.5	.....	.....	.....	.....	.....
La Crosse, Wis*...	24.0	.....	.....	.....	.....	.....
Dubuque, Iowa*...	16.0	.....	.....	.....	.....	.....
Davenport, Iowa*..	15.0	.....	.....	.....	.....	.....
Keokuk, Iowa*....	14.0	.....	.....	.....	.....	.....
Saint Louis, Mo ...	32.0	26	15.4	18, 19	8.5	8.5
Cairo, Ill	40.0	28	28.9	3, 4	17.8	11.1
Memphis, Tenn....	34.0	29	23.0	6	13.8	9.2
Vicksburg, Miss ...	41.0	1	24.8	9	19.7	5.1
New Orleans, La ..	13.0	3, 24	8.9	12	7.3	1.6
Ohio River:						
Pittsburg, Pa	22.0	27	10.6	1	2.6	8.0
Cincinnati, Ohio ...	50.0	16	27.1	3	8.5	18.6
Louisville, Ky.....	25.0	15, 16, 17	10.7	3, 4	5.8	4.9
Cumberland River:						
Nashville, Tenn ...	40.0	15	18.1	3, 4	8.6	9.5
Tennessee River:						
Knoxville, Tenn ...	.....	11, 12	5.0	3	2.4	2.6
Chattanooga, Tenn .	33.0	13, 26	11.2	3	5.2	6.0
Monongahela River:						
Pittsburg, Pa	29.0	27	10.6	1	2.6	8.0
Savannah River:						
Augusta, Ga.....	32.0	26	29.0	3	8.1	20.9
Sacramento River:						
Red Bluff, Cal	.....	1	14.5	28, 29	2.4	12.1
Sacramento, Cal ...	.....	16	20.0	1	15.2	4.8
Willamette River:						
Portland, Oregon ..	.....	1	16.6	24, 25	3.5	13.1

*River frozen entire month. †Record for last 10 days only.

ICE IN RIVERS AND HARBORS.

Passamaquoddy Bay.—Eastport, Me.: floating ice in bay on the 19th.

Penobscot Bay.—The "Portland (Me.) Press" of the 15th contained the following:

ROCKLAND, *February* 14.—The ice which has closed up the harbors in this section since February 1st, started to-day. In the harbor, its departure was the cause of much excitement. It started here about noon, going out with the wind. The immense field of ice occupying the space from Owl's Head to Tillson's wharf, twelve to eighteen inches thick, started in a sheet and swung out in a body, taking all the fleet of vessels in winter quarters here that lay in its wake.

Portland Harbor.—Portland, Me.: the harbor was completely covered with ice from the 1st to 5th and 10th, and partially covered with ice on the 6th, 8th, 9th, 12th to 15th; floating ice in harbor on the 11th, 15th to 18th; ice disappeared rapidly on the 20th.

Boston Harbor.—Boston, Mass.: harbor froze over on 1st; ice broke up on 3d.

Wood's Holl Harbor.—Wood's Holl, Mass.: ice in harbor disappeared on the 14th.

Edgartown Harbor.—Edgartown, Mass.: navigation was suspended from 1st to 4th, and resumed on 5th; drift ice in harbor on the 11th.

Nantucket Harbor.—Nantucket, Mass.: ice was broken up by steamers and harbor cleared on 5th.

New London Harbor.—New London, Conn., 1st: many vessels which have come into harbor during the past two weeks are remaining on account of the harbors at other places being closed by ice. Floating ice in harbor on the 7th.

New Haven Bay.—New Haven, Conn.: the ice began to move out of harbor on the 14th.

East River.—New York City: floating ice on 29th.

Delaware River.—Port Jervis, N. Y.: the river was gorged for a distance of four miles on the 23d; the back-water flooded cellars and basements.

Bordentown, N. J.: large quantities of drift ice passed down the river on the 25th.

Philadelphia, Pa.: floating ice on the 2d.

Susquehanna River.—Port Deposit, Md.: the ice dam in the river at Garrett Island broke during the morning of the 25th.

Chesapeake Bay.—Baltimore, Md.: large quantities of floating ice were encountered on the 13th in the upper bay, causing considerable inconvenience to vessels.

Alleghany and Monongahela rivers.—Pittsburg, Pa.: floating ice in both rivers, 5th to 10th, 15th, and in Alleghany River 11th, 12th, 21st to 23d, 25th, 27th to 29th.

Genesee River.—Rochester, N. Y.: ice moved out of portions of river on the 23d.

Lake Erie.—Buffalo, N. Y.: the high winds of the 20th, 21st, and 25th broke up the ice in the lake.

Presque Isle Bay.—Erie, Pa.: the ice in the bay was twenty inches thick on the 16th.